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EIGHTH ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JAN. 18TH, 1897.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the Henry Shaw School of Botany is respectfully submitted, in compliance with the rules of the Board. At the request of the Garden Committee, in addition to a statement of operations for the past year, the present report includes a general summary of what has been accomplished since the organization of the Board in September, 1889.

THE BOTANICAL GARDEN.

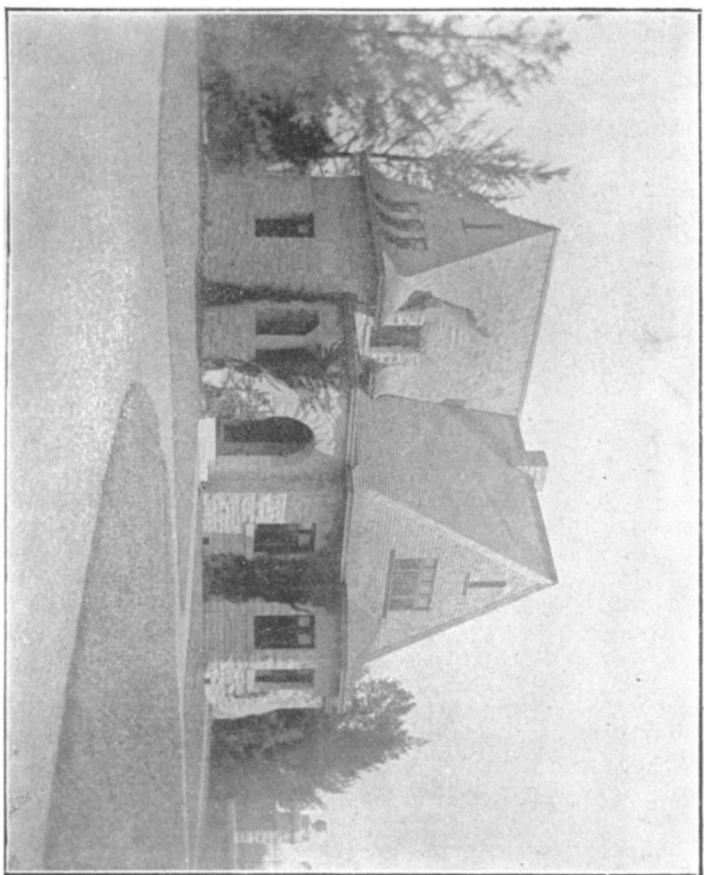
One of the first steps taken by the Board of Trustees was the adoption of a general outline policy for the guidance of the Director,* and, as this policy has not been materially changed, the instructions are here quoted, as a convenient means of noting such advances as have been made during the past seven years.

1. To continue or even augment the present ornamental features of the Garden.

2. To add to its botanical usefulness and interest by the introduction, as opportunity offers, of plants representative of the American flora, so that, other things being equal, these shall ultimately be largely represented and may even preponderate outside of the greenhouses, giving then, in the Garden, an epitome of the leading characteristics of our native flora.

3. To carry into execution, as rapidly as possible, a system of correctly naming and labeling all plants in the Garden, with the exception of such as may be used in ribbon gardening or for other exclusively ornamental purposes.

* First Report. 93.



THE MUSEUM GATE HOUSE.

4. To provide fire-proof quarters for the invaluable herbarium of the late Dr. George Engelmann, and to immediately mount it in the proper manner, so as to insure its preservation and availability for scientific use. Also, to provide for and add to the general herbarium (based on that of Bernhardt) now at the Garden, with the special object of ultimately making it complete in good representatives of American plants.

5. To arrange, bind, and index the books and pamphlets at the Garden. Also, to provide more ample but equally safe accommodations for the library, to bring it up to date as rapidly as possible, to enter subscriptions for periodical publications, and to keep it abreast of the times, and in the most useful form, by the purchase of important publications as they shall appear, and by the proper indexing of periodicals and pamphlets.

6. To secure a botanical museum, containing material needed for study or calculated to advance general or special knowledge of botany.

7. To direct the main energy of research for the present toward assisting in the completion of a systematic account of the flowering plants of North America, by the publication of monographs of different Orders and Genera, illustrated when this may seem desirable; and to specially cultivate representatives of such groups for purposes of study.

8. To gradually acquire and utilize facilities for research in vegetable histology and physiology, the diseases and injuries of plants, and other branches of botany and horticulture, as special reason for developing one or the other may appear

9. To make the facilities of the Garden useful in botanical and horticultural instruction, as they increase and opportunity for such work appears: meantime, in all feasible ways, to attract to the School of Botany students of promise, and to provide for their instruction and the best use of their time as investigators.

10. To take steps looking to the early appointment of six "garden pupils," — youths with at least an elementary English education, who shall be regarded as apprentices in the Garden, working under the direction of the head gardener and foremen, and shall hold scholarships yielding \$300.00 per year each, together with free lodging near or in the Garden, and free tuition in the School of Botany, and who, after having worked for six or more years (as shall ultimately prove best) in the different departments of the Garden, and proved proficient in its practical work, may be admitted to examination for a certificate of proficiency in the theory and practice of gardening.

11. To have in mind, in appointing associates for the Director, their special aptitude in some one of the branches indicated above, so that with each appointment the efficiency of the institution for instruction and original work may be broadened and increased.

On assuming control of the Garden, the Board soon saw that the large amount of unimproved real estate which fell to their care, and which was unproductive and at the same

time a source of present expense and of anxiety as to its future, since very expensive street improvements were likely to be ordered at any time, would necessitate great economy in the management of the Garden for some years; and it was early felt to be imperative that the annual expenditures should be closely limited to what was necessary for the maintenance of the Garden as it then existed, making provision for a very gradual development along certain of the lines indicated in Mr. Shaw's will, and embraced in the outline policy adopted by the Board, while leaving others for future attention, so that with as great rapidity as possible a reserve fund might be accumulated, sufficiently large to provide for the emergencies which were likely to arise in connection with the unimproved real estate. This policy, since the principal of the endowment could not be used, was obviously also the only one which would render possible the expenditure at any one time of considerable sums in effecting permanent improvements and extensions at the Garden, which it was easy to foresee would be necessary within a comparatively few years. Therefore, while the expenditures for the first two years after the organization of the Board were high, because of the necessity for immediate and extensive repairs in many directions, the annual amount available for maintenance expenses* was soon limited to \$30,000.00, to which, however, has been added each year, by special appropriation, such sum as seemed absolutely necessary for extensions and improvements which could not be deferred without detriment to the institution.

From the reports of the officers of the Board, as published in the annual Reports of the Garden, has been prepared the following tabulation of maintenance expenses:—

* Rept. ii. pp. 8, 16.



A WINTER SCENE.

SUMMARY OF EXPENSES.

ACCOUNT.	1889 (3 mos.)-1890. (Second Report).	1891. (Third Report).	1892. (Fourth Report).	1893. (Fifth Report).	1894. (Sixth Report).	1895. (Seventh Report).	1896. (Eighth Report).
GARDEN.							
Labor*.....	\$18507.48	\$20192.37	\$16582.92	\$15537.70	\$14096.62	\$13321.92	\$13343.30
Office Assistance.....	.....	.....	.....	.....	.....	.....	520.33
Fuel.....	1099.94	1066.81	1148.29	1487.00	1582.87	1275.52	818.48
Stable & implements.	578.50	813.79	802.00	598.18	604.44	374.95	859.11
Repairs & supplies...	8420.15	7701.46	2839.32	2371.45	1849.37	1920.45	2186.16
Plants & seeds.....	625.29	1020.49	736.43	618.35	284.08	1532.27	1194.73
	\$28928.36	\$30794.92	\$22108.96	\$20612.68	\$18417.38	\$18425.11	\$18922.11
HERBARIUM†.....	5208.91	3199.70	502.07	1418.41	880.51	1191.82	2276.87
LIBRARY.....	5532.38	4261.36	1602.78	4443.52	2614.90	4975.42	4461.17
OFFICE‡.....	6932.47	5174.25	5446.50	4609.06	5362.54	4889.32	4798.48
RESEARCH.....	.....	.....	.....	.....	475.50	871.10	1011.37
SCHOLARSHIP*.....	2467.06	1402.62	445.87	560.11	767.44	650.09	804.15
TOTALS.....	\$49069.18	\$44832.85	\$30106.18	\$31643.78	\$28498.27	\$31002.86	\$32274.15
SPECIAL IMPROVEMENTS....	Water pipe & residence, \$3905.18	Residence, \$11785.35	Library cases, etc. \$2808.06	Library cases, etc. \$255.37	Greenhouse and ponds, \$5135.25	Gatehouse, etc. \$10985.52	Extension & storm repairs, \$4986.11

* Up to 1892 the wages paid to garden pupils appeared as an item of scholarship expense, but since that date this expenditure has been carried as a labor item in the Garden Account.

† The large expenditures for the first two years were for mounting the Engelmann and Bernhardt herbaria.

‡ Until 1894, research expenses appeared under the Office Account. A part of the office salaries is now charged to Garden Account for various services rendered

While the amount of ordinary repairs carried as a part of the running expense of the Garden has been much smaller since 1892 than before that time, the employment of a more intelligent class of men as vacancies occur, more thorough organization of the labor, and improvement in the methods of caring for the Garden, by which a smaller number of men now do the work, have made it possible, also, to considerably lessen the proper maintenance gardening expenses, although the area of plant-houses has been increased, as well as the number and variety of plants grown; and this has been accomplished not only without a reduction in the wages of the gardeners, but notwithstanding an increase of about 25 per cent. in their wages.

During the year 1896, the ornamental features of the Garden were of the same general character as heretofore, and about the same number of species and nearly the same of individuals were cultivated for this purpose, in the open air, as in 1895. The house collections, on the other hand, especially that of orchids, have been considerably increased, both in size and variety. A conservative estimate by the Head Gardener shows that at present about two and one-half times as many species and named varieties of plants are cultivated as in 1889. At the end of 1895,* an inventory of the plants in cultivation at the Garden showed that 3921 named species and varieties, other than annuals, were cultivated at that time. During the past year, while considerable additions have been made, it is probable that certain species have dropped out of cultivation, so that in the absence of a special inventory it is possible to state merely that the number now in cultivation is unquestionably somewhat greater than that in 1895. As has been done in previous years, surplus bedding and plant-house material has been donated in considerable quantity to public kindergartens, hospitals, mission schools, and similar charities, something over 1500 plants having been so distributed. As

* Seventh Report, 14.

in the last few years, the impossibility of transmitting seeds and plants to foreign gardens, through the mails, has made it almost impossible to distribute seeds to such correspondents, and, as a result, only a few packets have been sent off. During 1896, 241 consignments of plants and seeds were received at the Garden, of which 175 consignments, aggregating 3967 plants and packets of seeds, valued at \$515.00, were donated or sent in exchange for Garden material.

It is estimated that, for various temporary reasons, the number of visitors to the Garden during 1896 was scarcely as large as in the preceding year. On the open Sunday afternoon in June, 10,598 persons passed the gate, and on the corresponding Sunday afternoon in September, 13,589 visitors were counted. So far as estimates can be made from the data at hand, the number of visitors to the Garden is now about one-half greater than in 1889, though, as no automatic register of visitors is kept at the gate, the estimates are not accurate. The multiplication and improvement of car lines by which the Garden can be reached make it probable that the increase noted will continue.

While many difficulties are encountered in securing the correct and permanent labeling of the collections of living plants, the gardeners are gradually coming to understand the necessity of care in preventing labels from becoming lost or separated from the plants to which they pertain. A considerable part of the time of an intelligent man is given to writing labels and supervising labeling, and by far the greater part of the collection is now fairly well and accurately labeled, the names adopted in the *Index Kewensis* being in the main employed, in accordance with the rules of the Society of American Florists * and a report adopted by the Madison Botanical Congress of 1893.†

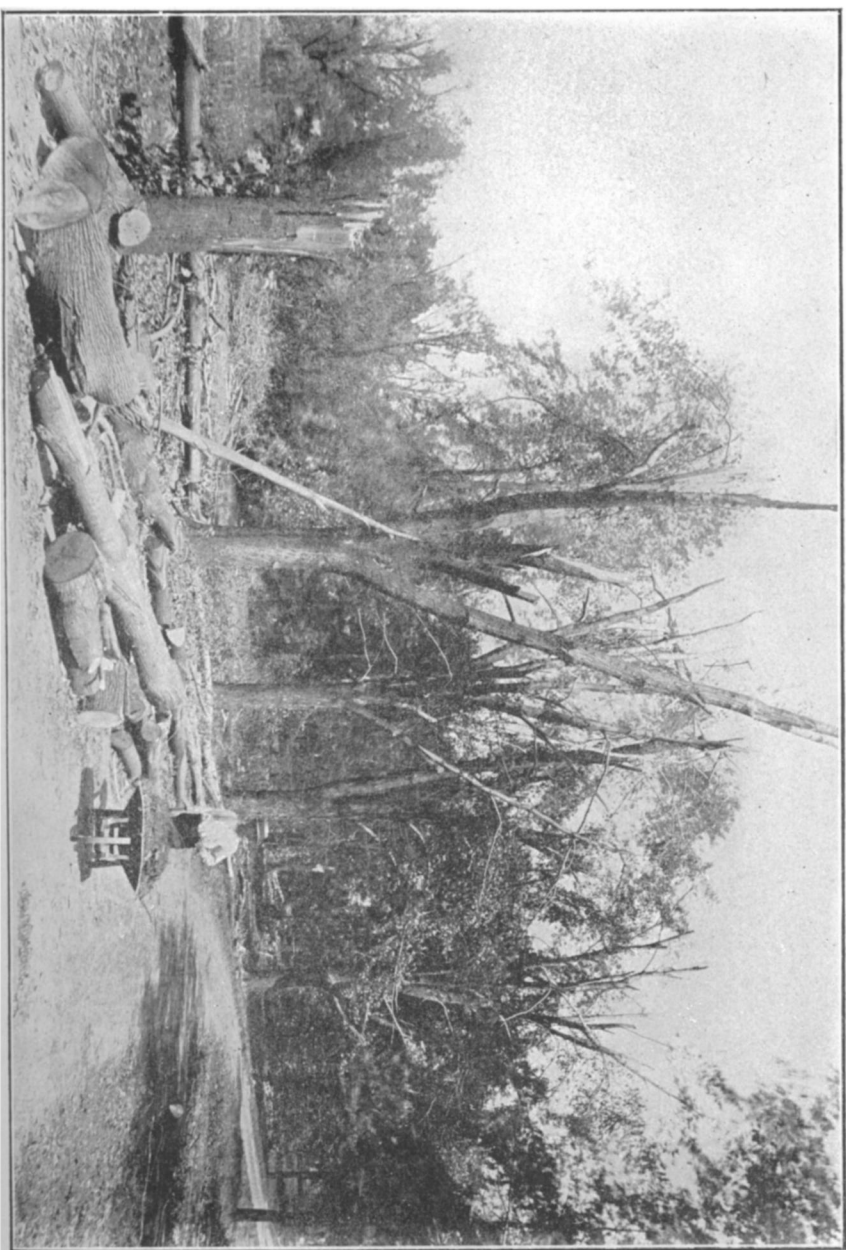
Though the gardening features have this year been main-

* Proceedings Socy. Amer. Florists, 1893, 91; American Florist, Aug. 17, 1893; Florists' Exchange, 1893, 730, 732.

† Proc. Madison Bot. Congress, 1893, 41.

tained, on the whole, in as creditable a manner as in 1895, in some respects the Garden has not been as attractive to the casual visitor as it was the year before. As a result of the most destructive hailstorm that has ever been experienced at the Garden, some 6,000 lights of glass were broken on the 21st of May last, the falling glass doing incalculable damage to many of the plants, which were further exposed to the weather for a considerable time. Cacti and other plants which are sheltered under glass during the winter, but which had been placed in the rockeries and elsewhere before the storm, were either destroyed or so badly bruised that it is impossible even yet to count the final loss. Some idea of the force of the falling hail may be obtained from the statement that the ribbed glass on the roof of the Linnean house, nearly a quarter of an inch thick, was in considerable part broken.

Closely following this storm, the tornado of May 27, which caused great loss of life and property in and about St. Louis, devastated a considerable portion of the Garden. While the grounds, fortunately, were not actually traversed by the cyclonic funnel, but were exposed only to the strong northwest gale which accompanied it, the violence of the wind was such that a number of the structures on the grounds were either unroofed or totally wrecked, while some 450 trees, many of them of large size, were wholly or practically destroyed, and a large percentage of those left standing were seriously broken. A more graphic view of the destruction of trees may be obtained from the statement that 186 cords of firewood have been prepared from the more workable trunks and larger branches of the trees removed. Aside from the direct injury, it is probable that no small number of those left have suffered from unwonted exposure to the strong sunlight of last summer and the winds of the present winter, so that many more are almost certain to require removal during the next year or two. It has been necessary to expend all told \$4,479.36 in such storm repairs as could be made, and the loss in



AFTER THE TORNAO.

specimen plants cannot be expressed in money. Furthermore, in addition to these direct storm repairs, a considerable increase has been made necessary in the ordinary maintenance expenses during the past season. But on the whole, there is reason for great congratulation that the Garden did not fare far worse, since its library and herbarium, because of the energetic action of my assistants, were practically uninjured, its greenhouses were soon renovated, and enough trees escaped to prevent the grounds from appearing ruined.

When the Board assumed control of the Garden, a small museum, containing both vegetable and animal material, was found open to the public; but as this had long been without the attention of a curator, the material proved to be in so dilapidated a condition as to require the closing of the museum. During 1890 and 1891, in the absence of other available quarters, the office of the Director was maintained in his residence, and this museum building was devoted to the housing of the herbarium and library, tables being provided in it for those who were engaged in research work. In 1891, in compliance with the will of Mr. Shaw, his city residence was removed from its site at Seventh and Locust streets, and, after careful consideration by the Board, was reconstructed in an essentially fire-proof manner within the Garden inclosure, and this building has been used for office, herbarium, library and laboratory purposes since the end of that year, the intention being that it shall ultimately form part of an extensive system of fire-proofed structures devoted also in part to museum purposes.

During the period of time covered by this report, the herbarium has increased from 159,046 unmounted specimens, constituting the Engelmann and Bernhardt * herbaria,

* In answer to questions already asked by friends of the Garden, and to remove doubt which may subsequently arise, it may be stated that this is the herbarium of Professor Johann Jakob Bernhardt, who was born in

to 258,629 mounted specimens, protected by impregnation with corrosive sublimate. The present composition of the herbarium, in which 10,793 specimens derived by purchase and 5,674 specimens received as donations or in exchange have been incorporated in 1896, and from which 1,061 unmounted duplicates have been distributed, is as follows: —

The Engelmann herbarium (all groups), about..... 97,800 specimens.

The general herbarium of higher plants: —

The Bernhardt herbarium.....61,120

Other specimens.....80,843

141,963 “

The collection of Thallophytes: —

The Bernhardt herbarium..... 126

Other specimens.....18,740

18,866 “

Making a total of about..... 258,629 “

Valued at.....\$25,862 90

Practically as part of the herbarium, the following material is noted: —

Wood specimens of various sizes..... 1,027, valued at \$100 00

Wood veneers, by Spurr, Hough, Nördlinger
and Michel..... 2,229 “ “ 150 00

Microscope slides, by Hough, Penhallow, Mun-
roe, and others..... 1,051 “ “ 250 00

Together..... 4,307 “ “ \$500 00

Erfurt, Germany, in 1774, and who died at Erfurt in 1850. Further information about the herbarium can be found in the earlier Garden Reports (ii. 25; iii. 15; iv. 12; v. 15; vi. 15; vii. 17), and in the Transactions of the Academy of Science of St. Louis, vol. i. page 316. At the Royal Botanical Garden at Berlin, Germany, is also a Bernhardt herbarium, formed, however, by a different person, namely Theodor Bernhardt, born in 1810, died in 1889, who, as I learn by a letter from Dr. Urban, was also a resident of Erfurt.— See also Engler's *Bot. Jahrbücher*, xiv. Beiblatt, Heft 4, p. 37.

The library, which at first contained considerably less than 5,000 volumes and pamphlets, has increased to :

Pamphlets.....	12,848			
Books (general).....	9,885	valued at.....	\$36,144	23
Books (Sturtevant Prelinlean library)*.....	463	"	2,315	00
MS. volumes (Engelmann)....	60	"	600	00
(Roetter)	1	"	100	00
Total.....	23,257	"	\$39,159	23
Index cards.....	165,969	"	\$1,659	69

During the past year, 219 volumes and 702 pamphlets, valued at \$539.55, were donated to the library, and 571 volumes and 1,216 pamphlets were purchased, \$3,310.45 having been expended for purchases and binding for the library. The index has been increased during the past year by the incorporation of 19,912 cards, of which 5,350 were purchased, and the remainder written by the Garden indexers.

Notwithstanding the provision of safe and, for the time being, ample quarters for the library and herbarium in the reconstructed city residence, it has not yet been found practicable to remove the numerous wood specimens, and other unattractive but necessary and valuable material, from the old museum building, so as to free the latter for other uses, nor has it proved possible to spare funds for the purchase of material and the salary of an assistant who should be charged with the installation and maintenance of a museum illustrating some branch of pure or applied botany, such as might be accommodated in this small building were it empty.

Aside from an increase in the plant-houses, and the accumulation of books, living and preserved specimens of plants and their parts, and a small collection of insects, no considerable facilities for research have been acquired at

* Reports iv. 14; v.16; vi. 16; vii. 18, 123-209.

the Garden thus far, the instrumental equipment of the School of Botany being found available for all necessary use by the few Garden employees and pupils, and, as yet, no properly equipped permanent laboratory rooms have been provided, adequate temporary provision being made in the herbarium building and the plant-houses for such work as has been undertaken. While in some respects much remains to be done, such facilities as have been secured thus far have been placed at the disposal of investigators, of whom one or more have occupied tables at the Garden for a period of from one month to a year, each season for several years past, three such investigators having been accommodated at the Garden during the current autumn and winter. By direction of the Board, a general announcement is made, by a widely distributed circular, in the early part of each year, that such facilities as the Garden possesses or can readily acquire for any worthy piece of investigation, are freely placed at the disposal of competent investigators.

For three years the Garden subscribed for a table at the Marine Biological Laboratory, at Wood's Holl, Massachusetts, as a means of securing the use of facilities for seaside study that it was impracticable to obtain otherwise, and the table was used during the summers through this period by Professor M. A. Brannon, who was thus enabled to accomplish an interesting and valuable piece of work on the life-history of one of the marine algae; but as no employee of the Garden could be spared for summer work at the sea-shore, it was deemed best, in 1895, to withdraw this subscription and apply the money directly to the home needs of the Garden.

While, for the reasons already stated, which have necessitated the most economical management possible of the Garden, the organization which has been effected has been the simplest which would insure the efficient maintenance of the grounds and a reasonable growth in the library and herbarium, the explicit statement of Mr. Shaw, in the fifth

paragraph of the second clause of his will * “ that scientific investigations in Botany proper, in vegetable physiology, the diseases of plants, the study of the forms of vegetable life, and of animal life injurious to vegetation, experimental investigations in horticulture, arboriculture, etc., are to be promoted,” has not been lost sight of. From the first, such small part of my own time and of the time of my assistants as could be spared from necessary administrative and curators’ work has been devoted to research, as a result of which a number of papers of greater or less extent have been published. An enumeration of such publications as have issued from the Garden or have resulted, in the main, from work done at the Garden since the organization of the Board, will appear elsewhere in the Eighth Report.

To provide a channel for the suitable publication and distribution of such papers, it was early decided by the Board to regard the historical volume issued in 1890 † as the first of a series of annual reports.‡ These volumes at first contained the official administrative reports, a detailed account of certain annual events provided for in the will of Mr. Shaw but not directly concerned with the Garden, and such scientific papers as might have been prepared during the year. Shortly before the sixth volume was issued, after a careful re-examination of the entire question of publication, and a decision by the Board that it was not only proper but desirable that the Garden should continue the printing of annual reports and memoirs, it was decided that, except when specially ordered published,§ the anniversary reports should be omitted from the annual volume,

* First Report, 37.

† “The Missouri Botanical Garden.”— Commonly cited as the First Report, or the Report of 1890.

‡ Second Report, 3; Third Report, 3.

§ As, for instance, was the case with the able address of President Henry Wade Rogers, — Seventh Report, 113.

leaving the latter as a presentation of the administrative and scientific results attained each year.*

From the Secretary's annual printed statements it appears that the cost of publishing and distributing the annual Reports thus far has been as follows:—

1890.	1891.	1892.	1893.	1894.	1895.	1896.	Total.
\$1,493 65.	\$1,465 05.	\$1,820 61.	\$2,272 09.	\$1,849 87.	\$1,275 31.	\$2,848 46.	\$13,025 04.

This expenditure, averaging \$1,860.72 per year, which includes the expense of a reissue of the first volume in 1893, and of the second and third volumes in 1896, has secured a first edition of 1,500 copies of each Report, and 500 copies of each reissue, enabling us to place sets in nearly or quite all of the centers of botanical research in the world, while the provision of a few hundred reprints of each of the more important scientific articles has rendered it possible for any botanist who really cared to use them to obtain the latter.

While wasteful distribution of the Garden publications has been avoided, as far as possible, and the Reports have been sent to permanent libraries, rather than individuals, except where special reason to the contrary existed, direct payment or an exchange equivalent is not demanded where there is reason to believe that they will be preserved in accessible places or used in serious botanical study. As a result of this policy, it is believed that papers published in the Garden Reports are within the reach of more working botanists than those printed in any other publication, at any rate on this side of the Atlantic.

Notwithstanding the liberal policy adopted in the distribution of the Garden publications, the object being to render them accessible wherever they were likely to be useful, rather than to see that they were not a source of expense to the Garden, they have now become the recog-

* Sixth Report, 3.

nized source of library and herbarium donations, the value of which, as estimated in the Director's reports for several years past, is as follows:—

	HERBARIUM.*	LIBRARY.†	TOTAL.
1893	\$324 75	\$609 05	\$933 80
1894.....	219 70	931 60	1,151 30
1895.....	284 15	799 97	1,084 12
1896	230 65	539 55	770 20
Average.....	\$264 81	\$720 04	\$984 85

Ignoring as a separate item the reprints which have been issued from the Reports, as being relatively inexpensive (though the cost is included in the cost of reports above given), an analysis of the publication account shows that for an expenditure of \$13,025.04, 12,000 copies of the Reports have been printed, making their average cost \$1.09 each. About 2,800 copies now remain for future use, so that the actual cost to the Garden of the accessions reported above is \$9,985.86, or an average of \$1,426.55 per year.

In addition to the Reports, in 1893 the Garden issued, for the convenience of visitors, a small handbook, attractively illustrated and bound in leatherette, stating in a concise form the history of the establishment, and indicating a few of the features of interest. By instruction of the Board, this handbook has been offered for sale by the gate-keeper, at the approximate cost of publication, namely 25 cents per copy.

In the fourth paragraph of the second clause of his will,‡ the founder of the Garden declares his intention “that instruction to garden pupils shall be attended to, both in practical and scientific horticulture, agriculture and arboriculture.” From certain manuscript memoranda left by him, it appears that Mr. Shaw's intention was, at the first,

* Valued at the low rate of \$5.00 per hundred specimens.

† The valuation arbitrary and inexact, but in the main lower than the average selling prices of comparable books and pamphlets.

‡ First Report, 37.

to endow six scholarships for such pupils, lodging the latter at Garden expense, making them a certain cash allowance each year while they remain at the institution, and giving them all necessary opportunities for both theoretical and practical instruction. Guided by these directions and suggestions, the Board, in 1889, created six such scholarships,* at first fixing the course of study at six years, but afterward † shortening it to four years.

The present status of the course for garden pupils is indicated in the following eighth annual announcement, which is reprinted from a pamphlet issued in November, 1896:—

In accordance with the intention of its honored founder, the Trustees of the Garden offer theoretical and practical instruction for young men desirous of becoming gardeners. It is not intended at present that many persons shall be trained at the same time, nor that the instruction so planned shall duplicate the excellent courses in agriculture now offered by the numerous State Colleges of the country, but that it shall be quite distinct and limited to what is thought to be necessary for training practical gardeners.

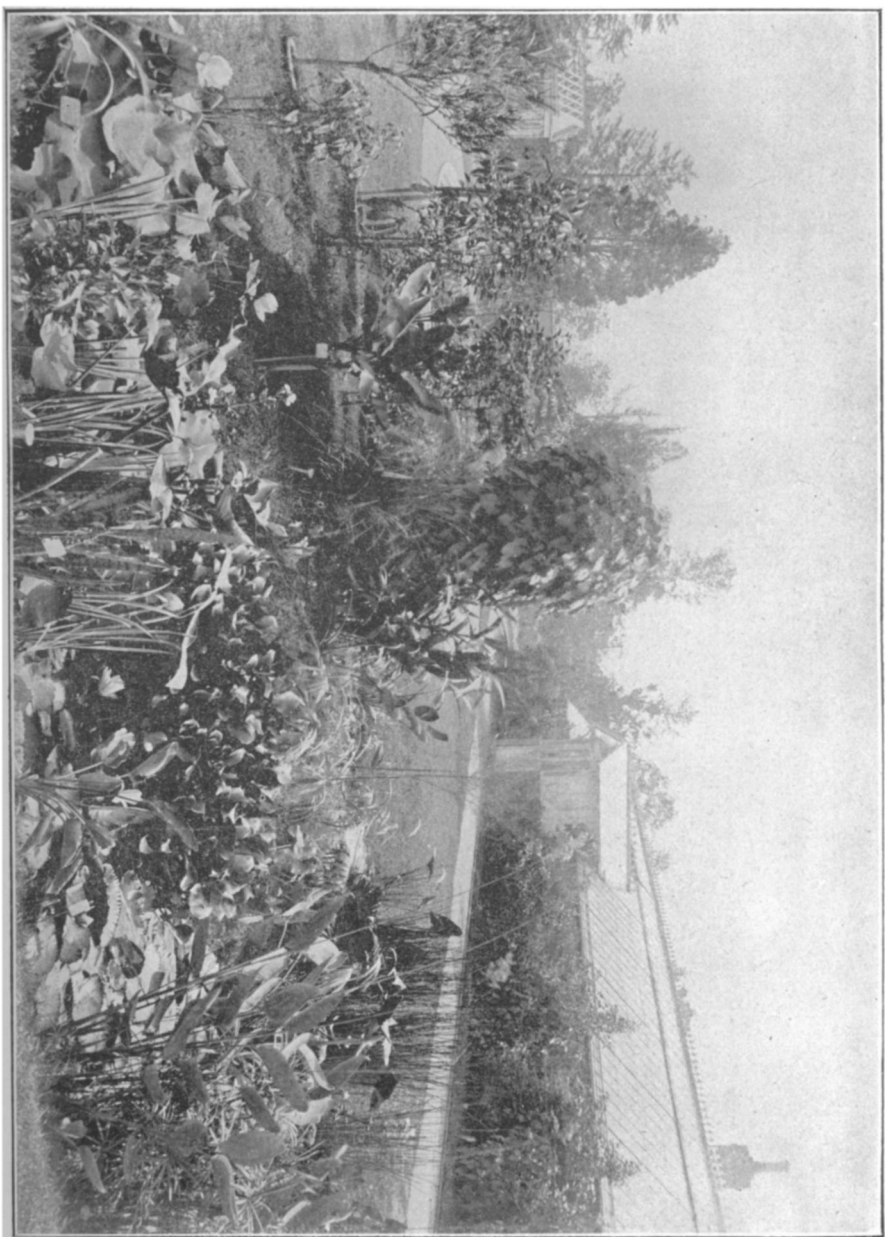
To this end, resolutions were adopted by the Trustees, at a meeting held on the 19th of November, 1889, and amended at a meeting of March 9th, 1892, as follows:—

“*Resolved*, That there be established the number of six scholarships for garden pupils of the Missouri Botanical Garden, to be available on and after April 1, 1890, such scholarships to be awarded by the Director of the Garden on the results of competitive examination, except as hereinafter provided, to young men between the ages of 14 and 20 years, of good character and possessing at least a good elementary English education; each scholarship to grant such privileges and be subject to such conditions as are provided below or may subsequently be provided by the Trustees of the Garden.

“Until otherwise ordered, two such scholarships shall be reserved for candidates to be named by the State Horticultural Society of Missouri, and the Florists' Club of St. Louis, respectively; provided, that such candidates shall be given scholarships only after passing satisfactory preliminary examinations, and shall be subject after appointment to all tests and regulations prescribed for other candidates and pupils, and that if the names of such candidates are not presented by the Societies designated, within sixty days after such action is requested by the Director, the vacancies may be filled by him on competitive examination, as in other cases.

* First Report, 94.

† Fourth Report, 17.



AQUATICS.

"Each scholarship so conferred, may be held by the original recipient for a period not exceeding four years, subject to the following conditions:—

"Each garden pupil shall be required to lead a strictly upright and moral life, and shall be courteous and willing in the performance of all duties prescribed for him. He shall devote his entire time and energy to the labor and studies prescribed for him, except that from time to time he may be granted leave of absence to visit his home or for other good reason, at the discretion of the Director, provided that the aggregate of such absences in any calendar year shall not exceed thirty days. He shall also show such ability in his work and studies as to satisfy the Director that it is advantageous for the scholarship to be held by him; and from time to time he may be subject to both theoretical and practical examinations, or may be given special tasks calculated to test his knowledge or resources. Failure to meet the requirements in any one of these respects, making due allowance for extenuating circumstances, shall forfeit all claim on any scholarship, which may then be awarded to another person in the prescribed manner.

"Garden pupils, appointed as above indicated, shall be regarded as apprentices in the Botanical Garden, and as such shall be required to work in it under the direction of the Head Gardener, performing the duties of garden hands. They shall be successively advanced from simpler to more responsible tasks; and, in such order as may seem best, shall be transferred from one department of the Garden to another, until they shall have become thoroughly familiar with the work of all.

"To the end that garden pupils shall be repaid for their services to the Garden, and that the absence of pecuniary means need not deter any young man from obtaining such training as is contemplated, each regularly appointed garden pupil holding a scholarship shall be entitled to the following wages, payable in equal installments at the end of each fortnight: For the first year, \$200.00; for the second year, \$250.00; and for each year after the second, \$300.00; together with plain but comfortable lodgings convenient to the Garden.

"In order that they may have opportunity to become instructed in the theoretical part of their profession, and in subjects connected therewith, such pupils shall not be required to do manual work in the Garden for more than five hours per day after the first year, devoting the remainder of their time to the study of horticulture, forestry, botany and entomology, under the direction of the Director of the Garden; and they shall for this purpose be granted free tuition in the School of Botany of Washington University. They shall also receive practical instruction in surveying and book-keeping, so far as a knowledge of these subjects is held to be necessary for a practical gardener charged with the management of an estate of moderate proportions.

"At the expiration of four years, the holder of a scholarship, who is recommended as practically proficient, shall be entitled to examination by the Garden Committee, in the subjects prescribed for study, and on passing such examination to the satisfaction of the Committee and Direc-

tor, he shall receive a certificate of proficiency in the theory and practice of gardening, signed by the Chairman of the Garden Committee and the Director of the Garden."

Under the above provisions, the following eighth announcement is made:—

One scholarship will be awarded by the Director of the Garden, prior to the first of April next. Vacancies which may subsequently arise will be filled annually, after published announcement.

Applications for this scholarship, to receive consideration, must be in the hands of the Director not later than the first day of March. The preliminary examination will be held on Tuesday, March 9th, at the Botanical Garden, St. Louis, at 10 a. m. If there is more than one applicant, competitive examinations, based on the subjects indicated below, will be held at the same place on Friday and Saturday, March 12th and 13th.

Candidates who live at places remote from St. Louis, and who wish to be spared the expense of coming to the city for examination, may send with their application the name and address of the principal of the nearest high school or of some approved private school, in case he is willing to take charge of such examination for them; but all applications of this character must be in the hands of the Director not later than the middle of February. If the examiner is approved, papers will be sent to him before the date set for the examination, and on the payment of a fee of \$2.00 to him, the candidate may write on them in his presence on the day specified. If competitive examinations are also required, the same examiner will receive the papers for them in time to submit them to the candidate on the date set for similar examinations in St. Louis, on receipt of an additional fee of \$3.00 as a partial payment for his time in conducting the examination. The papers written on such examinations will be forwarded by the examiner to the Director of the Garden, who will read them in connection with those written in St. Louis, before making any awards.

The successful candidate will be started in his duties as a garden pupil on Friday, April 2d, at the Botanical Garden.

All applicants for scholarship, whether named by the Societies indicated above or not, are examined in the following subjects, so far as they are taught in the upper classes of grammar schools: English grammar, reading, writing and spelling; arithmetic; and geography.

Whenever the number of candidates for scholarships exceeds the number of scholarships to be awarded, all candidates except those named by the Societies indicated, are required to pass a further competitive examination, covering history of the United States, English literature, algebra, German, the elements of botany, zoology, and physiology, and such other subjects as may from time to time be prescribed. It is not intended to make the passing of examinations in these last-named branches a requirement for the award of scholarships, but merely in this way to obtain a means of selecting the most deserving and able candidates when it is necessary to reject some. Hence, the Director will always use his discretion as to the importance to be attached to

greater or less proficiency in any of the subjects covered by competitive examinations, as well as to the other qualifications of candidates admitted to such examinations.

Scholarship pupils are lodged free of cost in furnished rooms in a spacious dwelling adjoining the Garden, under the charge of an employee of the Garden. Table board is not supplied, but wholesome food can be obtained in the lodge at reasonable cost (at present, \$13.00 per month). The lodge contains a reading-room supplied with the more valuable horticultural and agricultural papers, and also with a small but standard collection of books on the same subjects, which the pupils have free use of, and under needful restrictions they are permitted to make reference use of the general library of the Garden, which already comprises some 10,000 volumes and 10,000 pamphlets relating to all branches of pure and applied botany. So far as possible, the surroundings of pupils are made home-like, and, without assuming any responsibility for their behavior, an effort is made to subject them to influences calculated to insure for them gentlemanly manners and habits of industry and investigation.

During the first year of their scholarship, garden pupils work at the practical duties of the Garden nine or ten hours daily, according to the season, the same as regular employees of the Garden, and are also expected to read the notes and articles referring to the subject of their work, in one or more good journals. After the first year one-half of each day is given to manual work, the remainder being devoted to class work as outlined in the appended table.

The 76 class exercises per week here tabulated (each extending over three months), may be grouped under subjects as follows:—

Gardening:

Floriculture.....	8	
Vegetable gardening.....	4	
Fruit culture.....	8	
Forestry.....	3	
Landscape gardening.....	3	
Selected thesis work.....	4	30

Surveying and drainage.....	6	
Bookkeeping and accounts.....	4	
Economic entomology.....	5	

Botany in its relation to gardening:

General botany.....	8	
Botany of decorative plants.....	5	
Botany of hardy woody plants.....	3	
Botany of fruits.....	2	
Botany of vegetables.....	1	
Botany of weeds.....	1	
Economic mycology.....	7	
Vegetable physiology.....	4	31

COURSE OF STUDY.

YEAR.	TERM.	STUDIES.					PER WEEK.
SECOND.	April to June.	Floriculture. 3 exercises weekly.	Economic Entomology. 1 exercise weekly.		Surveying. 2 exercises weekly.		6
	July to Sept.	Floriculture. 3	Economic Entomology. 2	Book-Keeping. 1			6
	Oct. to Dec.	Floriculture. 1	Economic Entomology. 2		Surveying 1	Elementary Botany. 3	7
	Jan. to Mar.	Floriculture. 1	Twigs of Woody Plants. 1	Orchard Culture. 1	Landscape Gardening 1	Elementary Botany. 3	7
THIRD.	April to June.	Vegetable Gardening 4			Landscape Gardening 1	Elementary Botany. 2	7
	July to Sept.		Economic Mycology. 1	Orchard Culture. 2	Landscape Gardening 1	Botany of Garden Flowers. 2	6
	Oct. to Dec.		Economic Mycology. 3	Garden Accounts. 1	Botany of Fruits. 2		6
	Jan. to Mar.		Economic Mycology. 3		Botany of Weeds. 1	Botany of House Plants. 2	6
FOURTH.	April to June.	Orchard Culture. 1	Forestry. 1	Book-Keeping. 1	Surveying and Drainage. 3		6
	July to Sept.	Small Fruit Culture. 4				Botany of Vegetables 1	6
	Oct. to Dec.	Special Gardening 2	Forestry. 1	Vegetable Physiology 2		Botany of Woody Plants. 2	7
	Jan. to Mar.	Special Gardening 2	Forestry. 1	Vegetable Physiology 2		Botany of Ferns. 1	6

All of the above subjects capable of being taught in the laboratory, the greenhouse, or the field, are so taught, and all of the theoretical instruction is expected to be practically tested in the performance of the manual work required of students, the object being to make practical

gardeners and not botanists or other scientific specialists of garden pupils.

The second year's work only is now given each year, while the work of the third and fourth years is given alternately to two combined classes.

Vacations are granted from July 1 to 15, and December 21 to January 4, inclusive.

By the further action of the Board of Trustees taken at its meeting of November 16th, 1894, the Director is authorized "to admit, in addition to those holding garden scholarships, as many suitably prepared garden pupils as can, in his judgment, be adequately taught without material increase in the cost of tuition, each pupil so admitted to be charged \$25.00 per year tuition, and to be entitled to the same certificate as a scholarship pupil on completion of the prescribed course and examinations."

In conformity with this action the Director is prepared to consider applications from persons desirous of entering the Garden next April as pupils *without any of the scholarship grants or payments*, and subject to the payment of a tuition fee of twenty-five dollars at the beginning of the class year, namely on or about the first of April, each year. Such candidates will be examined on the grammar school studies mentioned on page 28, as required of all scholarship pupils, and will be entitled to take such examinations at a distance from St. Louis in the manner indicated on page 28, if they so desire. Pupils of this class, as well as those holding scholarships, will be received only with the understanding that they expect to complete the full course of four years, and in case a pupil is obliged for any reason to leave the Garden, he will not be entitled to a refund of any part of the tuition fee for the year.

Applications for scholarships, or inquiries concerning admission to the Garden as pupils, are to be addressed as below, on or before the dates mentioned on page 28. If required, blanks will be mailed to persons who contemplate making application for scholarships.

WILLIAM TRELEASE, Director,
Missouri Botanical Garden,
St. Louis, Mo.

Most of the pupils first appointed were either too far advanced in practical gardening experience, or too anxious to enter upon the duties and responsibilities of life, to make good students, so that only one of those first appointed completed the course. Four others have since received the certificate given on completion of the course of study. While the number is yet too small to permit positive conclusions to be drawn as to the usefulness of the course, it is gratifying to note that two of the pupils have gone to

practical horticultural positions in agricultural colleges on completing their work here, while one, after a season's study in the Arnold Arboretum, has begun a year's further work at the Kew Gardens.

In March, 1896, three pupils completed the course of study and were given certificates, namely, Clyde M. Blankinship, Arthur T. Erwin, and Emil Mische. In conformity with an announcement issued in the preceding autumn, the three vacancies thus created were filled by the appointment of Walter Retzer, of St. Louis (who for some time had been a special student), on the nomination of the Florists' Club of St. Louis, and the appointment of Charles W. Deusner and Cornelius Winther on the results of examination.

At the Horticultural Congress held in Chicago, in 1893, in connection with the Columbian Exposition, the subject of horticultural education was discussed by the Director of the Garden and other persons,* attention being called to the course of study adopted at the Garden. In 1895, at the Pittsburg meeting of the Society of American Florists, a paper of somewhat comparable scope was presented by Mr. Charles Jackson Dawson,† in which the St. Louis course of study was made the basis of comparison. Quite recently, Mr. Emil Mische, one of the garden pupils, who had received a certificate, presented a paper before the Gardeners' and Florists' Club of Boston,‡ in which the work done at the Garden is quite fully set forth. Besides these articles, which are directly concerned with the course as offered at the Garden, a considerable number of appreciative notices have appeared in both the American and foreign press, from time to time.

Although it must be admitted that the instruction of a small number of pupils makes the relative cost of training

* Florists' Exchange, 1893, 748.

† Proc. Soc. Amer. Florists, 1895, 41.

‡ Printed in the American Florist of Oct. 17, 1896, 244.

each high, there is reason to believe that this provision of Mr. Shaw's will in time will be productive of much good, while if, as is to be hoped, the number of pupils shall be ultimately increased, the results attained by a given outlay can in all probability be considerably augmented. Under the present instructions of the Board, three special students have thus far been admitted, and of these, one, a Japanese gentleman of good elementary training, after remaining at the Garden for a year and a half, was recalled and placed in charge of an important horticultural school which has been established in his native country.

The necessity of keeping the office staff down to the smallest possible limits, has thus far prevented the appointment of permanent associates for the Director, such as were contemplated in the outline policy of the Board quoted above, and it has seemed best to treat the assistants' positions as being virtually fellowships, enabling young men of fair botanical knowledge, but little experience, to fit themselves for more responsible positions while doing the necessary routine work of the Garden. It is gratifying to note that of the four regular botanical assistants appointed before the middle of 1896, two have gone to responsible college positions and one has assumed charge of a branch of the botanical work of the United States Department of Agriculture. The position vacated by the resignation of Mr. Thompson in the summer of 1896 has been filled by the appointment of Mr. J. B. S. Norton, formerly an assistant in the botanical department of the Kansas Agricultural College. Of the three regularly appointed horticultural assistants, one died while in the service of the Garden, where he was doing very efficient work, one has been called to the chair of horticulture in the University of Missouri, while the third, Mr. Irish, is still at the Garden.

Four annual events provided for in Henry Shaw's will have taken place in 1896, as follows: the preaching of a sermon "on the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the

vegetable kingdom;” * the seventh “banquet to the Trustees of the Garden” * and their invited guests; the seventh “banquet to the gardeners of the institution, and invited florists, nursery-men, and market gardeners;” * and the award of “premiums or prizes to a flower show,” * held in St. Louis.

The flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May 17th, by Right Reverend Ellison Capers, of South Carolina.

The Trustees’ banquet was given at the Mercantile Club, on the evening of May 1, and was presided over by Mr. Henry Hitchcock, Vice-President of the Board of Trustees, eighty-five representative gentlemen being present. Speeches appropriate to the occasion were made by Hon. F. W. Lehman, Prof. F. Lamson Scribner, of the United States Department of Agriculture, Mr. Alexander G. Cochran, Hon. Jas. O. Broadhead, Prof. Howard Ayers, of the University of Missouri, and Gen. George H. Shields.

The seventh annual banquet to the gardeners of the institution, and invited florists, nurserymen, and market gardeners, was given at the Mercantile Club, on the evening of September 16. Covers were laid for about 125 guests, among whom were the members of the Association of American Cemetery Superintendents, in convention in St. Louis, the gardeners of the Botanical Garden, representative florists, market gardeners and nurserymen of St. Louis, officers and representative members of the Missouri State Horticultural Society and of similar societies of Illinois, the President-elect of the Society of American Florists, a number of representative amateur horticulturists of St. Louis and vicinity, and members of the office staff and Board of Trustees of the Garden. The Director of the Garden presided, and after the dinner appropriate speeches were made by O. C. Simonds, of Chicago, Presi-

* First Report, 49.

dent of the Association of American Cemetery Superintendents; Hon. Norman J. Colman, late Secretary of Agriculture of the United States; Adam Graham, of Cleveland, President of the Society of American Florists; W. M. Bulkley; Hon. R. Graham Frost; H. C. Irish; and W. M. Chauvenet.

The flower premiums for 1896 were awarded through the officers of a chrysanthemum show held in the Exposition Building, St. Louis, November 11 to 15, the awards in general being made for plants and flowers similar to those entered in previous years. Unfortunately, owing to the absence of suitable entries, it has again proved impossible to award the Shaw medal founded by the Board in 1893.*

The Board of Trustees having become fully convinced that, because of the prejudice against leasing land for residence purposes, it would not be possible to carry out the intentions of Mr. Shaw, as expressed in the first and third paragraphs of the first clause of his will,* they brought suit to the April Term, 1896, of the Circuit Court, City of St. Louis, praying for a decree authorizing them to sell certain of the unproductive real estate; in which suit the State of Missouri, by its Attorney-General, as guardian of the public interests, and all of the heirs at law of Henry Shaw, were made defendants. On June 8, the cause came on for hearing, the Attorney-General appearing in person, and was submitted to the court upon full proofs, and on the 17th of August a final decree was handed down, by which the present Trustees and their successors in trust are authorized and empowered to sell certain specified revenue real estate,

— “on such terms and conditions as they may from time to time deem advisable, at public or private sales, and in making such sales said trustees are authorized, empowered and directed in and by the deeds to be executed by them, to impose such restrictions and conditions as may be found practicable, as to the character of the improvements upon said property so sold and the purposes for which the same may be used, so

* Reports v. 18; vi. 20; vii. 22.

* First Report, 32.

that said property by its contiguity may be pleasant and attractive to the visitors and students of the Botanical Gardens. Said trustees are also authorized in their discretion, before making such sales, to lay out, plat, grade and improve such portions of said tracts as they may deem desirable, as residence parks or districts, with such restrictions as to building lines, cost and character of improvements to be erected by purchasers, and the use to which said property shall be put, as said trustees may deem desirable and appropriate, in order to realize as far as practicable the said intention of said testator as to the surroundings of said Botanical Gardens. Said trustees are also authorized to lay out such streets and alleys as may be necessary to said premises, and if deemed desirable or expedient, to dedicate the same, or parts thereof, as public highways. Plaintiffs and their successors in trust are also authorized and empowered to apply the moneys now on hand, and such of the future revenues of said trust as may be available therefor, or such parts of such moneys or revenues as may be deemed by them expedient, in paying the special taxes and other improvements on said premises, and the proceeds of sale of such premises, when sold, may be applied by them to the payment of special taxes which may be imposed on said tracts, or any of them, of the improvement thereof, or to the special taxes on or to the improvement of other of said tracts not so sold. Such of the proceeds of sale as may not be required for such purposes shall be invested in approved securities or in the betterment, reconstruction or restoration of the income-producing property of the trust, or in the improvement of any of the unimproved property of the trust, and only the income of such proceeds of sale so invested shall be used for the support of the trust."

In view of the important interests involved, the Attorney-General deemed it proper to appeal from this decree to the Supreme Court, in which the cause is now pending; and until that court shall render a final decision, the trustees have not undertaken to exercise any of the powers so conferred upon them.

The accumulation of a reserve fund sufficient to meet the more probable temporary emergencies, and the possibility of exchanging more or less of the unimproved real estate of the Board for productive property, have made possible the contemplation of an increased expenditure for the purposes of the Garden, not only for annual maintenance, but for the permanent enlargement of the grounds and the amplification of the scope of the institution, to bring it into full conformity with the intentions of its founder. In compli-

ance with a request of the Board, in November 1895 a general plan for extension and development was submitted by the Director, and the more essential parts of this report are here quoted, as forming a comprehensive statement of the main ends to be attained.*

GENERAL PLANS FOR PLANTING.

In providing for the future of the Garden, three principal objects must be kept in view: beauty, instructiveness, and adaptability to research. So far as development of the grounds and plant houses is concerned, it seems to me that future extensions and changes should be conducted on essentially the following lines, decided upon definitely in advance, and adhered to as closely in detail as ever-changing conditions may permit, so that each step that is taken is a part of a definite, carefully considered general plan, while the inevitable mistakes can be easily detected and promptly rectified without resulting harm.

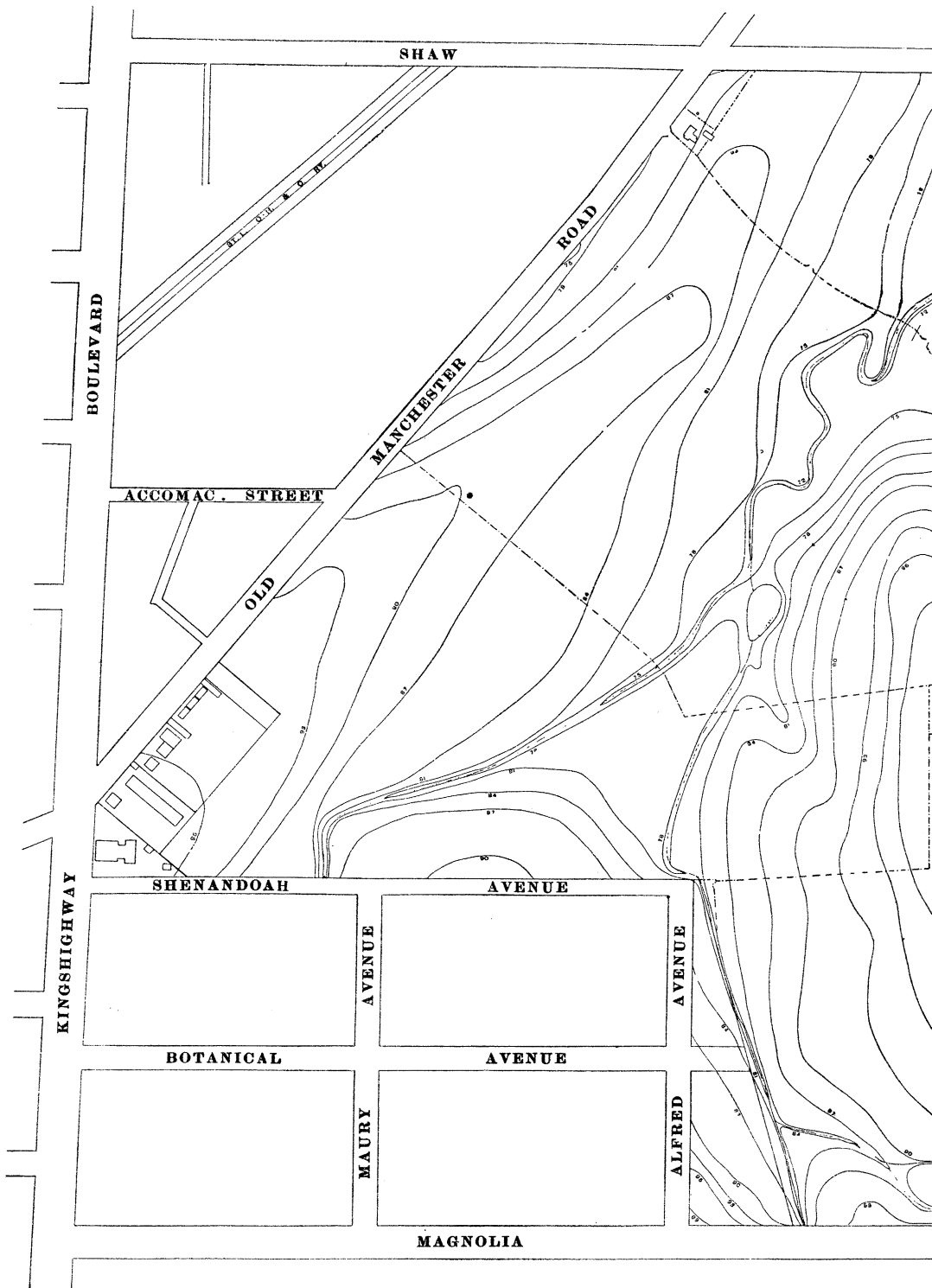
For florists' forms, including general transient decorative plants, the present garden, lying along Tower Grove Avenue, and bounded by the fruticetum, the arboretum, and the Director's residence, seems to me to be amply sufficient. This portion of the grounds, which at present constitutes the most attractive part of the Garden, falls far short of what it can be made to be, but its improvement, which is being carried on, is of necessity only partial. To obtain the fullest results from this tract of ground would necessitate what I have no doubt will ultimately be done,—the clearing, to a very large extent, and suitable rearranging and replanting of the entire tract. In this area, comprising some thirteen acres, I think that it will always be possible to cultivate in adequate quantity a sufficient variety of the most attractive decorative plants, many of which are tender and must consequently be propagated anew each year. This portion of the Garden, on which the greater part of the maintenance fund is now spent each year, must always, from this fact, continue to be the expensive portion of the Garden to maintain. To supplement the grounds, a much extended system of greenhouses must also ultimately be provided. A beginning has been made toward this by the erection in 1894 of a house facing the Victoria pond, this house constituting the central portion of a proposed range extending from the present house into palm towers at the east and west, with houses of the general construction of the present one running south from these towers. Whenever the funds of the Board and the general status of the Garden shall warrant it, it will also prove not only desirable, but necessary, to

* This report in full was part of the testimony in the suit of R. J. Lackland et al. vs. R. F. Walker, Attorney-General, et al., above mentioned. See page 203 of the printed abstract of record in said cause in the Supreme Court of Missouri.

construct a large palm house, in which larger specimens may be grown than in any of the present houses, and to this palm house will ultimately be annexed a rather extensive system of houses of the same general construction as the house built in 1894. With these facilities, granting an adequate maintenance fund and competent gardeners, the floricultural side of the Garden will, I think, be amply provided for.

For horticulture, in the general sense of vegetable and fruit gardening, the fruticetum, the renovation of which was begun in 1890 by the planting of a small collection of trees, which are just coming into fruit, and continued during the past season by the removal of most of the old trees and the substitution of carefully selected young nursery stock, together with the present vegetable garden at the rear of the Director's residence, will serve all necessary purposes, so far as the work at the Garden is concerned. Ultimately, it may prove necessary to acquire suitable orchard and garden property somewhere in the country for the performance of scientific experiments, but there is no reason why land within the present bounds of the Shaw property should be reserved for this purpose in making plans for the future, since experimental work of this kind, should it ever be carried on on a larger scale than is possible on the space now reserved, will undoubtedly necessitate removal from the smoke and soot of the city. For this work the vegetable house and grapery constructed in 1895, in the vegetable garden, can be extended by the enlargement of the present house and the building beside it of several other similar houses, as these may be needed.

For educational purposes, aside from those served by the maintenance of a large and varied collection of named plants, representing those of purely botanical interest as well as those yielding useful products or of decorative value, synoptically arranged groups must be especially planted. Up to the present time, it has been possible to do such planting only in a limited way; but whenever the revenue of the Board shall justify it, it will prove desirable to extend the garden so as to include the part which is now kept as farm and pasture, lying in general to the southwest of the present garden, and bounded roughly by the Manchester Road, Shenandoah Avenue, Alfred Avenue, Magnolia Avenue, and the limits of the present garden. This tract includes some 82.5 acres, of which about 20 acres would be cut off by a line drawn from the southern point of the arboretum to the farm house, and from that extending westwardly to the intersection of Shenandoah and Alfred Avenues. In providing for a future extension of the garden, this tract, which is geographically separable from the remainder of the farm, offers an opportunity for securing at once a very attractive piece of landscape gardening and a synopsis of the flora of the United States. So far as I know, no botanical garden has ever presented a synopsis of the flora of the country in which it is situated, so arranged as to be artistically attractive; and this is perfectly possible in this 20-acre tract extending northwestward from the corner of Magnolia and Tower Grove Avenues. In this tract should be found representatives of all cultivable families of United States plants, comprising the more representative genera and a



B. H. COLBY, 1896.

CONTOUR MAP OF THE GARDEN AND ADJACENT GROUND, FURNISHING DATA FOR PRO



1 IN. = 400 FT.

OUR MAP OF THE GARDEN AND ADJACENT GROUND, FURNISHING DATA FOR PROPOSED IMPROVEMENTS.

few of the more representative species of each which are capable of successful growth in the climate of St. Louis; but the object should be to avoid the introduction of any exotic species, as well as of too large a number of species native to this country.

The remainder of the present pasture, comprising some 62 acres, should at a subsequent period be planted to represent the flora of the world, so far as this is capable of open air cultivation in our climate, also planted for the greatest possible landscape effect, but, like the smaller tract, synoptically arranged.

Two principal ideas are now prevalent as to the natural affinities of plants: that exemplified in Bentham and Hooker's "*Genera Plantarum*," representing in the main the views of botanists like Jussieu, the DeCandolles, and Asa Gray, as well as the authors of the work cited; and that exemplified in the "*Pflanzenfamilien*," now in course of publication by Engler and Prantl. The former is the one most familiar to English, French and American botanists, and for this reason should be followed in the smaller plantation, devoted to the flora of the United States. The sequence of orders in the Engler and Prantl system, however, which is very different from that of Bentham and Hooker, should prevail in the planting of the general synopsis in the larger tract, inasmuch as it represents more closely than the other the phylogeny of the different groups of plants.

In arranging for the planting of these two tracts, which, from the nature of the planting, should be sufficiently distinct one from the other, and yet should merge into each other as a single piece of artistic landscape work, provision must also be made for the stables, compost grounds, and small nursery, necessary for the maintenance of a large garden, and also for certain small synoptical collections which may be called transient synopses, since they need not all be maintained at any given time, one giving place to another after a certain period of years. Such collections would represent medicinal plants, fiber plants, foliage and other economic plants, synopses of the botany of certain literary works, and of the various interrelations between plants and animals,—such, for instance, as a collection illustrating pollination of flowers, dissemination of seeds, climbing plants, carnivorous plants, the sleep of plants, etc., etc. These reservations, which must be centrally located, can be made very well in the vicinity of the present farm house, the synopses extending from this point to the southern apex of the arboretum, the two, properly screened by planting, forming a natural limitation between the synopsis of the American flora and the larger general synopsis, for which there will be left free about 60 acres.

For investigation, aside from the great amount of material which will be found in the plant houses and the grounds, as outlined above, special small groups must be planted from time to time, both in the open air and under glass. For these, which will of necessity be small, ample provision can always be made in the present garden, the fruticetum and vegetable garden, and the annexed greenhouses, without interference with either the object or the effect of these parts of the grounds.

Ultimately, however, as the revenue of the Garden increases, and the

opportunities for research grow, I have no doubt that the occasion may arise for the provision of research adjuncts at a distance from St. Louis, just as has been suggested for horticultural research. Such adjuncts might ultimately comprise a seaside garden for the study of maritime plants; an alpine adjunct, suitably located for the cultivation and study of plants which thrive only at high elevations; an arid region adjunct, where alone can be properly grown and studied in their natural form the cacti, agaves, and other characteristic plants of our southwestern flora; and perhaps ultimately a sub-tropical or tropical extension for similar work on plants which cannot otherwise be seen at their best. All of these, though, are extensions which need not in any way affect the planting and arrangement of the grounds now owned by the Board, and it may be that none of them will need detailed consideration during the lifetime of anyone now connected with the Garden, though they are all strictly within the legitimate purpose of the institution.

SEQUENCE OF STEPS IN DEVELOPMENT.

In realizing a general policy such as has been outlined, and the adoption of and adherence to which I consider very essential to the proper growth of the Garden as a unit, when the possibility of its extension may come, opinions may differ widely as to the order in which the various steps should be taken. To me, however, it seems that there is no question that the first step should be the planting at the very earliest practicable date of the synopsis of the United States flora, occupying a tract which is the most prominently located in the entire area to be improved; and for the last four or five years I have been cultivating this ground, in order to get it into a state of tilth suitable for planting. But before this step can be taken, it is quite essential that the general arrangement of the remainder of the grounds should be decided upon and approximately planned, so that the final result may not be scrappy. Assuming the adoption of the general apportionment of the grounds that I have indicated above, I have worked out detailed plans for the planting of the twenty acres which it is proposed to devote to a synopsis of the North American flora, and have also had my horticultural assistant and one of our senior garden pupils prepare independent ideas for the planting of the same piece of ground,—these plans, which differ in landscape treatment, being all based on the one fundamental purpose of making this tract one which will show the casual visitor as well as the careful student the types and affinities of our native flora.

Should the funds of the Board warrant the annual expenditure of a few thousand dollars, the work of improving this twenty-acre tract of ground can be begun immediately, the first step being of necessity the provision of suitable drainage, which will cost approximately \$1,900.00, and (if my plan in its main features should be adopted) grading to the extent of about \$3,000.00. It would not be desirable to attempt more than this for the first year, unless the Board felt that it could place the necessary water pipes upon the grounds, the expense for which would probably

be between \$2,000.00 and \$3,000.00. For the second year, the trees and shrubs needed for the tract could be wholly or partly planted, according to the plan, involving an expenditure of something under \$5,000.00. For the third year, the herbaceous plants needed for the completion of the scheme could be planted, rock work and smaller ponds needed for the growth of certain classes of plants provided, and the general surface of the ground smoothed and seeded to blue grass. In the following year, the drives, or so much of them as the available funds would allow, could be made, so that within a period of five years, for an annual expenditure of perhaps \$5,000.00, the entire ground could be improved and planted. These figures are entirely rough estimates, but I think that they represent with approximate accuracy the cost of getting the grounds in suitable condition. The annual maintenance of this tract, which in size would about equal the arboretum or the entire remainder of the present garden, including the fruticetum, vegetable garden and private grounds, has not been carefully figured out, but since it is proposed to cultivate in it only hardy plants, doing away with the necessity for the annual propagation of thousands of tender bedding plants, and since there will be large areas of lawn, so situated as to be capable of mowing by horse power, the cost of maintenance will fall very far below that of the present garden, probably calling for the employment of not to exceed five men, or an expenditure of somewhere from \$2,000.00 to \$3,000.00 per year.

In the meantime, say in 1897, if money could be spared for that purpose, it would be desirable to extend the greenhouse built in 1894 to the eastward, by an expenditure of \$3,000.00 to \$4,000.00, and in the following year the old and dilapidated little plant house standing obliquely between the agave house and the house of 1894 should be removed, and the latter house extended to the westward at an expense of from \$3,000.00 to \$4,000.00 additional.

By the time that the United States synoptical grounds were completed, and the trees and shrubs beginning to develop fairly, it would be desirable to suitably fence it on the east, south and west limits. For the east, I should suggest continuing the stone coping with iron pickets from the herbarium building to the grounds now occupied by the lodge, from this point securing the inclosure by the same style of fencing with overhanging wires that has been used between the arboretum and fruticetum and along the north end of the arboretum.

In about six years, this having been done, should the funds of the Board be materially increased, it would be practicable to begin the construction of a large palm house, for which provision has been made in the proposed United States synoptical strip, that being the most suitable site which can be found for such a house, since it is contiguous to Tower Grove Park, and will be suitably exposed to view from both Tower Grove and Magnolia Avenues. Such a house, built on the plans which I have been roughly preparing for a number of years, will cost, when completed, not far from \$75,000.00, of which perhaps \$40,000.00 can be used at first, the other expenditure to be made within the succeeding years in sums of

from \$10,000.00 to \$20,000.00 per year. In locating the palm house, to which ultimately will be appended a system of westward extensions, careful attention has been paid to the convenience and economy of managing the plant houses, the sites available for such a palm house, and the effect which such a house can be made to produce in the grounds; and after very careful study of the matter I am convinced that the only other site which would naturally suggest itself, namely, in the arboretum, to the west of the parterre, is quite unsuited because of the surroundings, while the connection of this large system with the present system of houses will not in any way facilitate the work of maintenance nor render possible economy in it.

These plans, which have been sketched in sufficient detail, as I believe, to meet the requirements of the Board, leave the main farm, of some sixty acres, for improvement at an indefinite date in the future, when the means of the Garden shall be very much greater than they now are; but with these improvements, which it is proposed to complete within a period of ten years, it will, I think, rank with any similar institution in attractiveness. By the time the North American synopsis has become fairly attractive, however, it will be possible to effect a radical and wholesale renovation of the present tract devoted to the garden proper, a renovation which it is impolitic to make until another piece of attractive planting has been effected, since for a period of years after grounds have been newly planted they are unattractive, giving promise only of what they are to be.

RESEARCH FACILITIES.

In the plans sketched above, all of the proposed planting and extension of the grounds has had reference to their usefulness for research as well as their instructiveness and beauty. But the great opportunity which Mr. Shaw's large bequest has offered the Board is not merely to secure beautiful and instructive grounds, but to advance the knowledge of botany by the performance of original investigation, and the Garden's success in the future will be measured largely by its attainments in this direction, since the arrangements which have been suggested above are certain to assure beautiful and instructive collections of both hardy and tender plants. Realizing this fully, I have, from the first, made a strong effort to secure all facilities for research work for which money could be spared, year by year, from the available income of the Board, and as a result of this effort the Garden possesses at present a very valuable library and herbarium; and an examination of its annual Reports will show that the small proportion of my time and that of my assistants which could be spared from necessary maintenance and executive routine has been productive of a considerable amount of such work. During the past five years, botanists from a distance have visited the Garden in some numbers, and have made use of its facilities for the performance of similar work, and the collections have always, when possible, been made available to competent investigators who could not visit St. Louis for the purpose of using them (a courtesy which I need hardly say is ex-

tended to the Garden staff by the principal other botanical institutions of the country). This acquisition of research facilities is, nevertheless, a thing which must continue for many years before the Garden is adequately equipped for the performance of such work as the Garden staff and visiting botanists should here find the opportunity for doing, and it is proposed, as rapidly as money can be spared for this purpose, to further extend both library and herbarium. The latter must also gradually be amplified by the provision of material which is too bulky, or otherwise unsuitable for incorporation in the herbarium proper, leading logically to the formation of a museum; and this research museum must, in part, also be arranged so as to become educational.

Mr. Shaw, many years ago, as the Board will remember, erected a building which he called a library and museum building, in which he maintained a collection of botanical and zoological material. At the time when the Board was organized, however, this had become so badly deteriorated that it was no longer a creditable display, and with the consent of the Garden Committee the museum was closed to the public. The limited room available for the work of the Garden staff and the storage of necessary but unattractive museum material, such as wood sections, etc., coupled with the limited sum which could be spared each year for Garden purposes, has compelled me, up to the present time, to keep the museum closed; but in the near future, the provision of an attractive educational museum must receive serious consideration, and it has been given frequent thought during the past six years. Yet it does not seem to me that it is as necessary immediately as the extension of the grounds which has been sketched above, and it is further very seriously complicated by the small size and entire inadaptability of the present building to the proper display of a museum collection. Still, I think that whenever the material which is now in the room can be stored accessibly for preservation elsewhere, a small synopsis of the entire vegetable kingdom, representing by models, drawings and specimens especially the lower groups of plants, which cannot be displayed in the grounds and green-houses, can be arranged in the present room.

To provide for the extension of the library, herbarium and museum, it is obvious that much more ample buildings than those now on the grounds must ultimately be erected. These it is proposed to cluster about the building now used for the herbarium, in contiguity to that building and to Tower Grove Avenue, so that they will all be conveniently accessible, and in the apportionment of the ground for other purposes allowance has been made for this; and it has been hoped that without interfering with the other plans mentioned above, the proposed synoptical museum could be arranged within two or three years, at a cost of perhaps \$3,000.00, while in about four years the funds of the Board might permit of a fire-proofed extension of the library building, costing approximately \$15,000.00.

With the growth of the grounds, library, herbarium and museum, it will become necessary to somewhat amplify the very simple present organization of the office staff. At present this consists of the Director,

with a horticultural assistant, a botanical assistant, an artist, an indexer in the library, and an amanuensis. As the facilities for horticultural work increase, however, it will be most desirable to make certain that the man to whom horticultural investigation is to be intrusted shall be a permanent employee,— a thing which cannot be counted on under the present arrangement,— and I shall shortly propose to the Board that the horticultural assistant be given to understand that there is a future for him in the Garden, if he proves worthy of it, and to promise him a definite annual increment in salary; but this is a matter to be considered in detail when the time for action comes. It will also be necessary to appoint a curator for the herbarium within a few years, with the same certainty of increase in salary up to an amount adequate to insure his remaining; and a librarian must also be provided. A curator for the museum, when established, will also be equally necessary, at least so soon as the museum has attained any considerable size.

Such research work as has been done up to the present time, as I have stated above, has been done by the office staff, in leisure hours. With the amplification of this staff, it will be possible for each of the appointees to become a prominent worker in the line of botany with which his duties are most intimately connected, provided he make suitable use of the facilities which the Garden is acquiring for investigation; but as time goes on, it is certain that the income from the Shaw bequest will make it possible to do much more than merely to provide facilities for research and to allow men to take from their necessary routine duties a small proportion of time for the performance of investigation. Perhaps in the entire planning of the future of the Garden there is no other subject deserving of so careful thought as this, for mistakes in the plan adopted may nullify this, which I regard as preeminently the opportunity of the St. Louis Garden.

Several ways exist for securing research when facilities are present. Material which can safely be loaned can be sent from the Garden to competent workers, as is now done. Material which cannot be loaned with safety can be freely placed at the service of visiting botanists, as is also now done; but I fear that the number of people who will annually visit the Garden at considerable personal expense will be comparatively small, because of the fact that nearly all investigators are men connected with university positions, often on small salary, and with no leisure excepting that of their summer vacations. To enable this class of men in any considerable number to utilize the facilities, I think that something more than merely offering them the facilities will be necessary. The greater number of successful colleges of the country have a certain amount of money which is each year expended in scholarships for undergraduate students. Possibly it may be considered desirable, in the remote future, to expend a certain proportion of the Shaw income for the endowment of scholarships in the School of Botany, just as has already been done for the gardening school maintained at the Garden; but any such expenditure will bring a class of men who are not prepared for research, but who come for preliminary training. In some of the wealthier col-

leges there is also a small sum available each year for traveling fellowships. This money is usually expended in such a way as to enable a promising student to continue his studies in Europe, under the direction of a master in the line of study selected by him. Probably, as the funds of the Board increase, the expenditure of a very few thousand dollars annually, in small grants of two or three hundred dollars each, may make it possible for investigators with partly completed work to come to the Garden and here complete their work during their summer vacation, while the endowment of a number of research fellowships, yielding perhaps \$1,000.00 per year, may make it possible for such men to come to the Garden for an entire year for similar work. These three possibilities, while they are probably located far in the future, are worthy of careful thought, so that when the possibility of action comes they may be judiciously acted upon.

Any investigation promoted in this way is most desirable, and is, as I interpret them, strictly within the purposes of the founder of the Garden, but it must not be overlooked that while such provisions will contribute to the advancement of botany, they do it indirectly, so far as the Garden is concerned, by enabling others to utilize what the Garden has acquired for such work. If the Garden itself is to become known as a center of investigation, it will be absolutely necessary to provide for the performance of a considerable amount of such investigation by the regular Garden staff, and this leads me to believe that as the institution develops it will not only be desirable but necessary to appoint, one after the other, young men of extreme promise who wish for a position which will enable them to do research work, and who, given this opportunity, will ultimately become leaders in their specialties. To secure such men, who can be appointed at a low salary, say of \$1,000.00 to \$1,500.00 each, it will be necessary to promise them that, if successful, their salaries will increase up to a suitable living salary, which in all probability will be dictated by the salaries usually paid by the universities of the country, since an investigator, as well as a teacher, must secure a living if he is to devote his time to investigation. I hope to live to see the income of the Garden so ample that it shall claim among its regular employees men recognized as the equal of any in the country, if not in the world, in horticulture, vegetable physiology, morphology, paleo-botany, phanerogams, pteridophytes, bryophytes, fungi, algae and lichens.*

Ultimately it is very possible that the money available for research work will admit of the employment in the same manner of an entomologist, and there is a possibility that in coming generations other branches of zoology may be represented, either directly under the Shaw

* Under the heading of "Botanical Opportunity," in an address delivered before the Botanical Society of America, in August, 1896, and printed in *Science* of September 18, 1896, p. 367, and the *Botanical Gazette* of September 1896, p. 193, I have further analyzed this question of equipment and its utilization, as concerning institutions like the Garden.

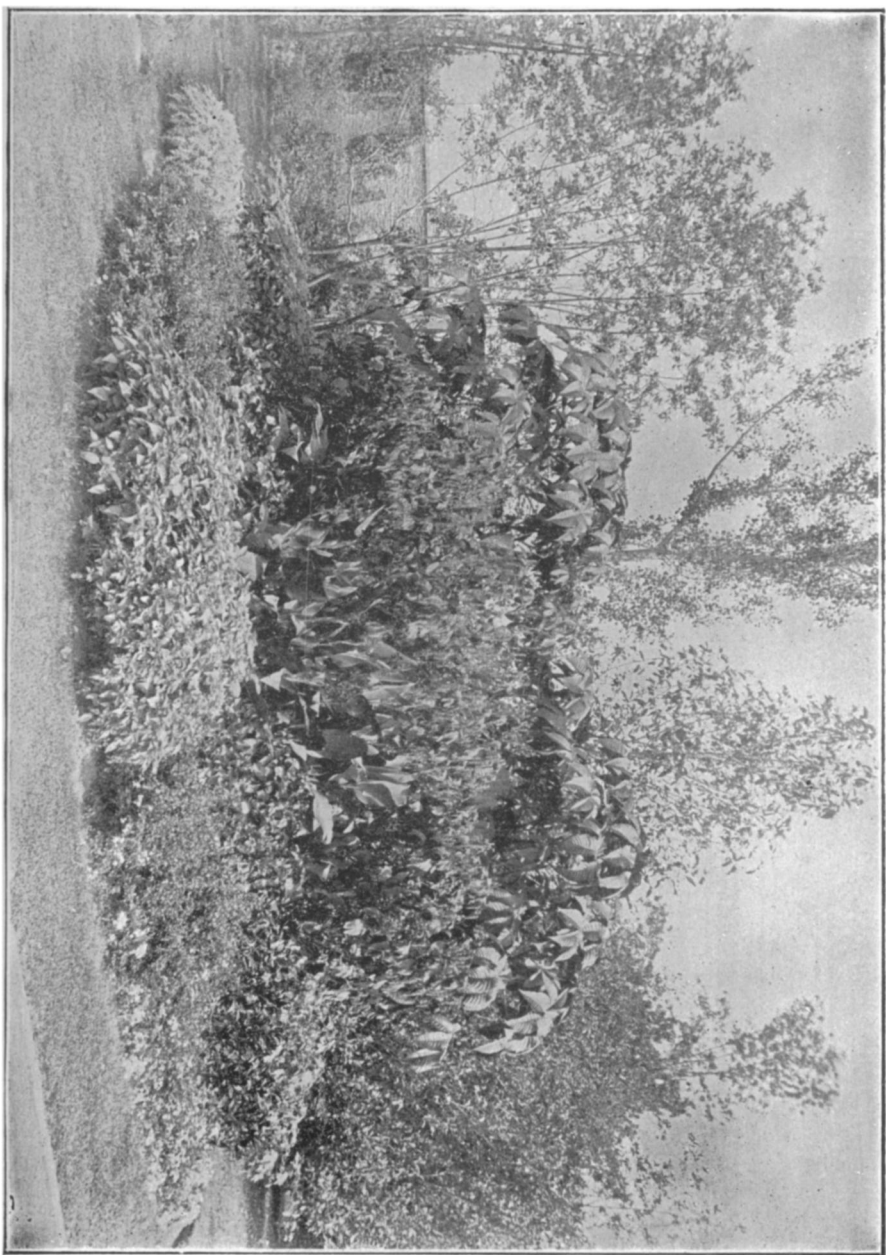
foundation or on specific endowments which may in time come to the Garden for this purpose, and with this in view I would suggest, in case the Board secure permission to sell real estate, that it reserve that portion of the ground immediately north of the arboretum and fruticetum, ultimately improving it and utilizing it so as to make it an adequate source of revenue, but retaining the ownership, so that a zoological garden, if it were ever rendered possible, might easily be provided at that point as an adjunct to the Garden.

These plans, which I have gone into in some detail, are, nevertheless, in the main, outline plans, and it is impossible to say, until the exact financial prospects for any given period of years shall be known, how rapidly they can be materialized.

Concurring in my opinion that one of the most necessary early steps is the suitable extension of the grounds, the Board have intrusted to Messrs. Olmsted, Olmsted & Eliot, of Brookline, Massachusetts, the preparation of a general plan for the improvement of the pastures contiguous to the present garden, including details for the planting of the proposed North American synopsis, and accompanied by suggestions for the future treatment of the land now under cultivation, so as ultimately to secure a harmonious and logical whole. In the main, the suggestions of the report here quoted have been adopted by this firm, with the single important exception that for the proposed palm house the second site noted in my report has been chosen as the more appropriate. While these extension plans are yet too incomplete to admit of any very definite statement being made, it is hoped that the finances of the Board may render possible their early inception and uninterrupted, if gradual, accomplishment. The unfortunate storm losses of the past summer will also, no doubt, necessarily bring the renovation of the present flower garden into the near future.

As a first step toward the extension of the Garden as an institution of research, the Board, since the preceding outline of plans was submitted, have converted the horticultural appointment into one promising a sufficient increase in salary to make it possible for us to retain permanently a desirable appointee, and there is reason to hope that in

MASSED HERBACEOUS PLANTS.



their proper sequence the other steps which have been recommended may be taken.

Notwithstanding the limited force employed in the care of the library and herbarium and on research work, and the necessity of economy in all expenditures, the desirability of enabling employees of the Garden to enrich the herbarium by the results of their own collecting (which is recognized as one of the first principles of museum administration), and to make ecological studies where plants grow among their natural surroundings, has found practical recognition in the action of the Board in sending Professor Hitchcock on a winter cruise to the British West Indies in 1890-91,* in enabling me to spend some weeks in Colorado, in 1891,† and some months in California and the arid regions of the southwest in 1892,‡ in a study of the Yuccas and their pollination, and in two extended vacations which I have been permitted to spend in a study of the botany of the Azores and Madeira.§ Assistants, on several occasions, have been sent on shorter collecting excursions. The Garden has also found itself in a position to enable Mr. B. F. Bush, an active student of the flora of Missouri and the adjacent region, to visit many interesting points in Missouri, Arkansas, and the Indian Territory, a full set of his collections being donated to the herbarium, while the Garden has published several papers based on them.||

THE SCHOOL OF BOTANY.

Mr. W. H. Rush and Mr. O. L. Simmons have continued, through the college year 1895-6 and 1896-7, to act as instructors respectively in general and cryptogamic botany. Undergraduate classes have been conducted in elementary morphology and organography (1),¶ elementary anatomy

* Reports ii. 31; iii. 14, 17; iv. 47; viii. *infra*. † Report iii. 159.

‡ Report iv. 16, 181.

§ Reports vi. 17; viii. 51.

|| Reports v. 15, 139; vi. 121.

¶ The numbers in parenthesis correspond with those used in the last

and phanerogamic botany (2), vegetable histology and its technique (5 and 6), applied mycology (11), vegetable physiology (14), and bacteriological technique (15). As in the preceding year, Miss A. I. Mulford has taught special classes at the Garden and elsewhere, especially adapting them to the needs of the teachers in the public schools of the city, in which a commendable effort is being made to introduce nature study as a part of the regular school work.

One candidate for the Doctor's degree has been engaged in resident work at the Garden during the present autumn.

Referring to a quinquennial report of progress published in the first Garden report,* and for subsequent details to the Director's report in each of the annual volumes,† it may be stated here that from a department controlling the time of one man and finding room in the University programme for only three short courses, the School of Botany has developed into an adequately manned department, offering a fairly complete and carefully selected series of courses open to students generally under the elective rules of the University.

In the arrangement of the electives now announced by the undergraduate department of Washington University, an effort has been made to include the smallest list of subjects which the School of Botany is prepared to teach, which, if followed, will lead to a reasonably good foundation knowledge of general botany, the expectation being that a student who has nearly or quite completed the series of electives may then devote not less than ten hours per week, through the entire Senior year, to some piece of special work,—such subjects, however, being so numerous and varied as not to require mention in a catalogue,

catalogue of Washington University and the Sixth Garden Report, pp. 24-5, bacteriological technique having been added last year.

* First Report, 84.

† Garden Reports, i. 98; ii. 31; iii. 18; iv. 19; v. 19; vi. 23; vii. 23.

since no two students would be likely to select the same subject.

Although the small number of students enrolled in the undergraduate department prevents and is likely to prevent the School of Botany from giving instruction to any large number of undergraduate pupils, certain of the courses are taken by a relatively large number. Indeed, for those courses which students have thus far shown a disposition to elect, the laboratories and lecture room of the School of Botany are utilized to their fullest capacity. It is a matter of regret, from a botanical point of view, that few students elect the more technical of the courses which are offered, their purpose in most instances being merely the acquisition of such knowledge of botany as forms part of a general system of culture. As the number of undergraduate students in the University increases, however, it is hoped that more use will be made by them of the facilities afforded by the School of Botany and the closely affiliated Botanical Garden.

As was stated in the inaugural address on the opening of the School of Botany,* the furtherance of investigation is held to be no less proper to a department than the giving of direct instruction; and the policy of furnishing to instructors as well as pupils all procurable aids to the performance of such work, adopted from the start† and never deviated from, has rendered possible the completion of several pieces of work, the larger of which have been made the subjects of papers published either as "Contributions from the Shaw School of Botany" or otherwise. The principal of these publications are noted elsewhere in the present volume. That no papers have been issued from the School of Botany during the past few years is due in part to the publication of my own papers in the Reports of the Garden, which now claims the greater part of my time, and in part to the increased amount of teach-

* First Report, 79.

† First Report, 100.

ing done at the School, since the adoption of an elective policy by the University has enabled undergraduates to make more use of the School of Botany.

Of the four assistants and instructors who have been connected with the School of Botany since its organization, besides the two who are still identified with its work, one was called to a college professorship of botany, one was engaged by the United States Department of Agriculture for the performance of physiological work, etc., in its sub-tropical laboratory, and the other two, after leaving the School of Botany, acted as botanical assistants at the Garden, from which they have been advanced to more responsible positions, — the plan at the University, as at the Garden, having been to consider these positions as transient, enabling incumbents to improve themselves during a limited connection with the School of Botany.

Very respectfully,

WILLIAM TRELEASE,

Director.